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# B201S/B202S

## 3U VMEbus Carrier Boards for M-Modules

User Manual

20B201S00 E4

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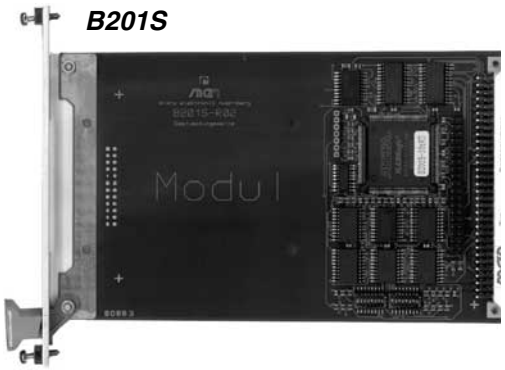
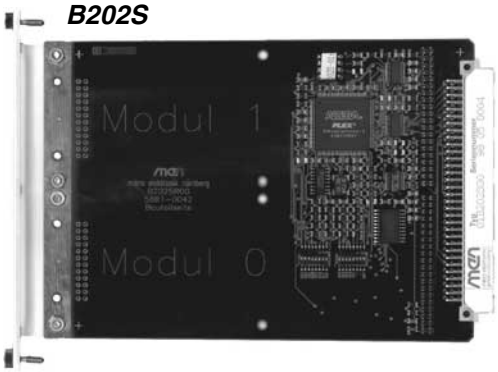
# B201S/B202S - 3U VMEbus Carrier Boards for M-Modules




The B201S and B202S are M-Module carrier boards for universal input/output applications on the VMEbus. The boards require one slot each on the VMEbus. M-Modules are screwed tightly on the carrier board.

While B201S can carry one M-Module, the B202S is slightly higher than standard 3U format, providing enough space for two M-Modules while staying compatible with VMEbus racks through special guide rails already included in the delivery.




The interrupt controller handles the M-Module's interrupt priorities. Its control and vector registers are user-programmable.

The B201S/B202S carrier boards have been designed for low power consumption.

The use of high-speed CMOS components reduces heating of the assembly, guaranteeing high reliability and long life.

## Technical Data

### *VMEbus*

- only one slot required on the VMEbus
- A24, A16, D16, D08 (E/O) slave
- D08 (O) interrupter

### *M-Modules*

- B201S: one M-Module slot on the board
- B202S: two M-Module slots on the board
- M-Module characteristics: D08, D16, A08, INTA, INTC

### *Compatibility*

- full compatibility with A201S (6U, 4 M-Module slots)
- functional compatibility with B201, B202 (2 M-Module slots) and A201N (4 M-Module slots)

### *Peripheral Connections*

- via front panel

### Electrical Specifications

- supply voltage/power consumption:
  - B201S: +5V (+5%, -0%) @ 350mA typ. (without M-Modules)
  - B202S: +5V (+5%, -0%) @ 320mA typ. (without M-Modules)
- MTBF: 52,000h @ 50°C

### Mechanical Specifications

- B201S:
  - dimensions: standard single Eurocard, 100mm x 160mm
  - front panel: aluminum with 1 handle, cut-out for front connector of M-Module
  - weight: 108g
- B202S:
  - dimensions: 110mm x 155mm
  - front panel: aluminum without handles, cut-outs for front connectors of 2 M-Modules
  - weight: 102g (without M-Modules)

### Environmental Specifications

- temperature range (operation): 0..+60°C (industrial temperature range on request)
- temperature range (storage): -40..+85°C
- relative humidity range (operation): max. 95% non-condensing
- relative humidity range (storage): max. 95% non-condensing
- altitude: -300m to + 3,000m
- shock: 15g/0.33ms, 6g/6ms
- vibration: 1g/5..2,000Hz

### Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

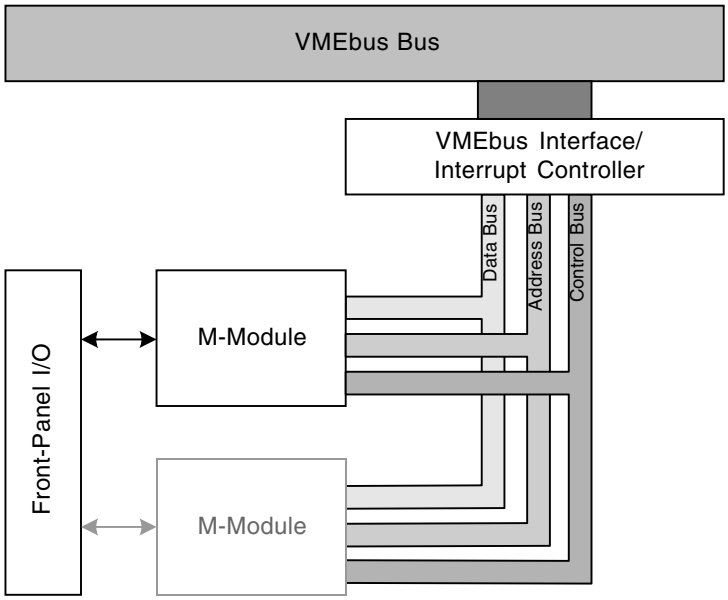
### EMC

- tested according to IEC1000-4-2 (ESD) and IEC1000-4-4 (burst) with regard to CE conformity

### Software Support

- M-Module drivers for WindowsNT, VxWorks, OS-9 as supported

# Block Diagram




# Ordering Information

***Standard Hardware***

| | |
|---|---|
| 01B201S00 | B201S VMEbus 3U, A24/A16/D16, for one M-Module |
| 01B202S00 | B202S VMEbus 3U, A24/A16/D16, for two M-Modules, incl. guide rails for rack installation |

***Accessories***

| | |
|---|---|
| 05M000-15 | 10 snap-in front panel covers for M-Module cut-outs at front panels |
| 05M000-17 | 25 mounting screw sets to fix M-Modules on carrier boards |

***User Manuals***

| | |
|---|---|
| 20B201S00 | B201S/B202S user manual, available for free download at www.men.de |

# About this Document

This user manual describes the hardware functions of the boards, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the boards.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

**Unless explicitly stated, the name "B201S" refers both to the B201S and B202S M-Module carrier boards in this user manual.**

## History

| Edition | Description | Technical Content | Date of Issue |
|---|---|---|---|
| E1 | First edition | Jonny Speckner | 1994-11-25 |
| E2 | Second edition | Jonny Speckner | 1995-12-04 |
| E3 | Third edition | Jonny Speckner | 1998-07-06 |
| E4 | Fourth edition, B201S and B202S in one user manual | Thomas Eckert | 2000-12-19 |

## Conventions

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

*italics* — Folder and file names are printed in *italics*.

**bold** — **Bold** type is used for emphasis.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

`0xFF` — Hexadecimal numbers are preceded by "0x", which is the usual C-language convention, and are printed in a monospace type, e.g. `0x00FFFF`.

/IRQ — Signal names preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous edition of the document.

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# 1 Getting Started

This chapter will give an overview of the carrier boards and some hints for first installation in a system as a "check list".

## 1.1 Map of the Board

***Figure 1.*** *Map of the Board - B201S - Top View*

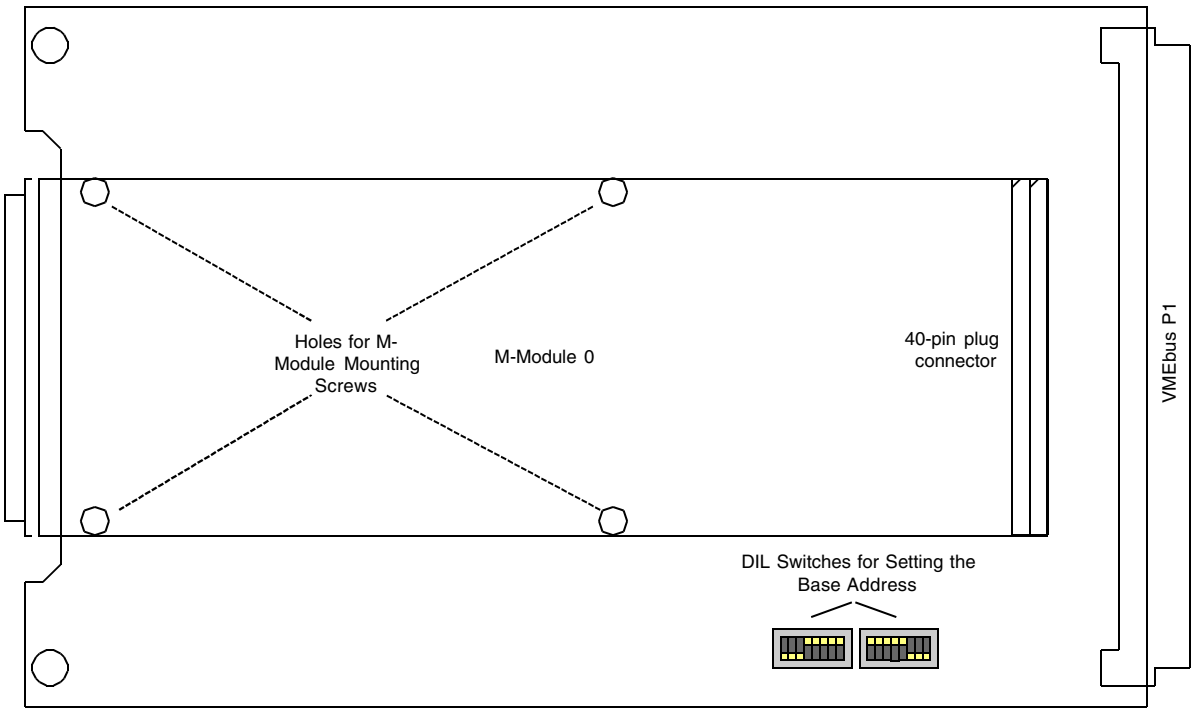
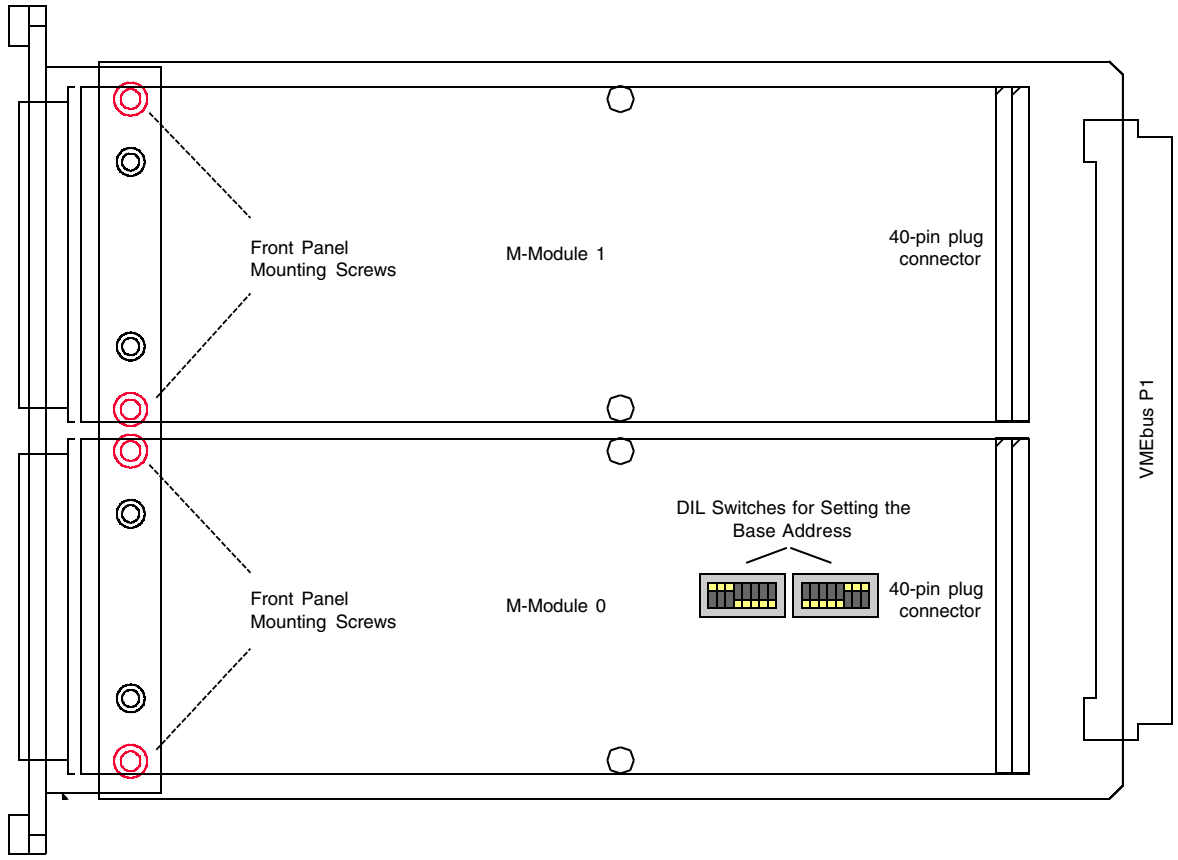


***Figure 2.*** *Map of the Board - B202S - Top View*



## 1.2 Installation Check List

You can use the following hints and "check list" to install the carrier board into a VMEbus system for the first time and to test proper functioning of the board.

The B201S has an A24/D16 or A16/D16 VMEbus slave interface. If it is required for the board to issue an interrupt via the bus, then the daisy-chain must be established through to the B201S.

The carrier board is completely trimmed on delivery. Perform the following procedure without an M-Module installed!

- ☑ Power-down the system.
- ☑ The board is set for A24 accesses, the base address being `0xE00000`. This base address is set using DIL switches. It may be necessary to set it to an address with which the master can access the board in A24/D16 mode.
  (If you have to change the base address, please refer to Chapter 3.2.1.1 Setting the Base Address on page 16.)
- ☑ Insert the B201S into your VMEbus system, making sure that the VMEbus connectors are properly aligned.

Note: The B202S is slightly higher than standard 3U Eurocard format, so that it can accommodate two M-Modules. Its dimensions are 110mm by 155mm. Because of this deviation you need special guide rails to install the B202S in your 3U VMEbus system, which are included in the standard B202S delivery. The rails are also available as a standard product directly from Schroff (guide rail for 4.4" cards), order no. 60817-038.

- ☑ Power-up the system.
- ☑ After power-up, load a suitable debugger.
- ☑ First, attempt to perform a read-word access to the base address plus `0x100`, (i.e. `0xE00100` if the base address was not altered).
  With 32-bit masters it may be necessary to load a register on the master board to set the access mode. In any case you should be aware of the contents of the high-order byte of the 32-bit address. For instance, access may require using address `0x`**`FF`**`E00100` or `0x`**`FC`**`E00100`.
- ☑ If a bus error occurs while you are attempting to read, check if the base address is set correctly and whether it is possible for the master to access the VMEbus at all at the selected address and using the correct mode. Then try again.
- ☑ Now attempt to perform a word access to the base address plus `0x102`. Again, no bus error should occur. Write accesses to this memory location should be successful for the right half of the word. For instance, if `0x55` is written to the register it should be possible to read `0xxx55`.
- ☑ You must have completed this test successfully before you begin to integrate an M-Module into the system (see Chapter 1.3 Installing M-Modules on page 12 and description in the respective M-Module manual).

Note: Interrupts cannot be tested in this simple fashion.

## 1.3 Installing M-Modules

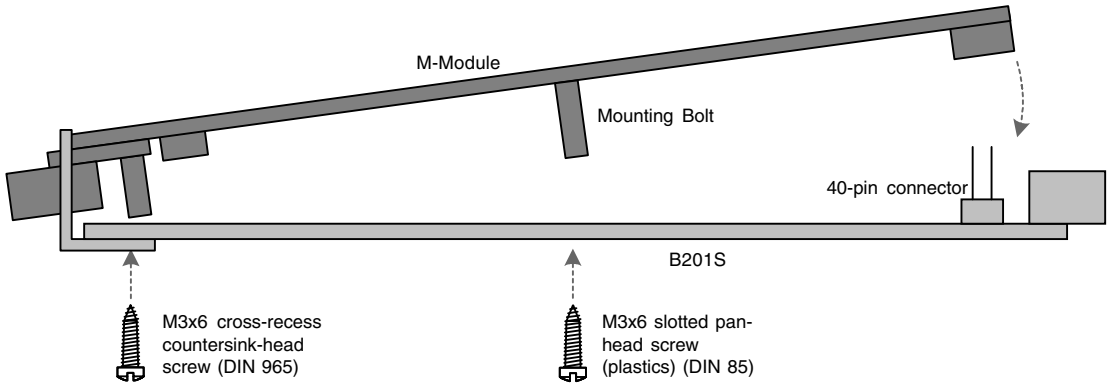
### 1.3.1 Installing an M-Module on B201S

Perform the following steps to install an M-Module:

- ☑ Hold the M-Module over the target slot of the B201S with the component sides facing each other.
- ☑ Put the M-Module's front connector through the front panel slot, holding the M-Module at a 45° angle.
- ☑ Align the 40-pin connectors of the M-Module and carrier board.
- ☑ Press the M-Module carefully but firmly on the B201S, making sure that the connectors are properly linked.
- ☑ Turn the B201S upside down and use four M-Module mounting screws to fasten the M-Module on the solder side of the B201S.

Note: You can order suitable mounting screws from MEN, see Chapter Ordering Information on page 4.

***Figure 3.*** *Installing an M-Module on B201S*



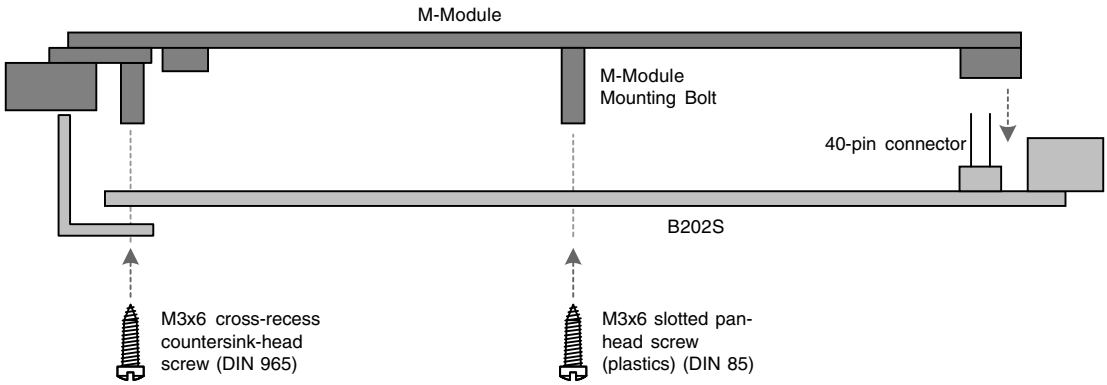
### 1.3.2 Installing an M-Module on B202S

Perform the following steps to install an M-Module:

- ☑ Remove the four front panel mounting screws and thus the front panel itself. (See Figure 2, Map of the Board - B202S - Top View, on page 10.)
- ☑ Hold the M-Module over the target slot of the B202S with the component sides facing each other.
- ☑ Align the 40-pin connectors of the M-Module and carrier board.
- ☑ Press the M-Module carefully but firmly on the B202S, making sure that the connectors are properly linked.
- ☑ Turn the B202S upside down and use four M-Module mounting screws to fasten both the M-Module and the carrier board front panel on the solder side of the B202S.

Note: You can order suitable mounting screws from MEN, see Chapter Ordering Information on page 4.

***Figure 4.*** *Installing an M-Module on B202S*



## 1.4 Installing Driver Software

For a detailed description on how to install driver software please refer to the M-Module's software user manual.

# 2 Address Organization

As mentioned above, the B201S occupies an address space of 0x800 bytes on the VMEbus. These 0x800 bytes are divided into four identical parts. Each 0x200-byte part is assigned to one M-Module slot. 0x100 bytes are used for addressing the M-Module itself. The remaining 0x100 bytes are used to address a part of the interrupt controller. Since the B201S has only one M-Module slot and B202S has two slots, 0x400 and 0x600 bytes remain unused, respectively, but ensure full compatibility with the A201S board (see grey text in the address map below).

***Table 1.*** *Address Map*

| Offset Address | Function | M-Module |
|---|---|---|
| 0x000..0x0FF | M-Module | 0 |
| 0x101 | Control Register | |
| 0x103 | Vector Register | |
| 0x200..0x2FF | M-Module (only B202S) | 1 |
| 0x301 | Control Register (only B202S) | |
| 0x303 | Vector Register (only B202S) | |
| 0x400..0x4FF | M-Module | 2 |
| 0x501 | Control Register | |
| 0x503 | Vector Register | |
| 0x600..0x6FF | M-Module | 3 |
| 0x701 | Control Register | |
| 0x703 | Vector Register | |

The base address *base* of an M-Module is calculated by the formula

$$base = B201Sbase + modslot \cdot 0x200$$

*base* M-Module base address
*B201Sbase* base address of B201S
*modslot* M-Module slot number on B201S

### Example

The base address set for the B201S is 0xE00000. An M-Module is plugged into M-Module slot 2. The M-Module base address is then

$$0xE00000 + 2 \cdot 0x200 = 0xE00200$$

For instance, if we are dealing with a 32-bit master which addresses the standard address area at 0xFFxxxxxx, then the M-Module at address 0xFFE00200 is selected. The corresponding interrupt control register then has address 0xFFE00301.

# 3 Functional Description

## 3.1 Power Supply

The 5V power supply from the VMEbus is sufficient for the carrier board. Some M-Modules (e.g. serial interfaces) need ±12V as well.

## 3.2 VMEbus Interface

### 3.2.1 Slave Interface

The B201S board is equipped with an A16/A24/D16 slave interface, i.e, only cycles with standard (24-bit) addresses and short (16-bit) address range are supported. For accesses from the VMEbus, the slave recognizes this type of cycle on the basis of the address modifier lines. The data bus interface of the B201S complies with the D16 specification. However, some M-Modules with a data bus width of only 8 bits permit only D08(O) accesses. The slave recognizes this type of access by the state of lines DS0*, DS1*, LWORD* and A1. The B201S will operate with masters which support so-called "address pipelining". The access time on the B201S depends on the M-Module concerned. DTACK* is generated 120ns after AS* at the earliest. The maximum time is limited to 10µs - in line with the M-Module Standard.

#### 3.2.1.1 Setting the Base Address

The B201S occupies an area of `0x800` in the address space. Identical quarters of this - that is `0x200` - are reserved for four M-Modules together with the interrupt handler. Since the B201S supports only one M-Module and B202S supports two M-Modules, an address range of `0x400` or `0x600` remains unused, respectively. This ensures full compatibility with the A201S, which has four M-Module slots.

The base address of the B201S can be varied in increments of `0x800` within the whole A16 or A24 address range. It is set using DIL switches. There is one switch for each address bit from A11 to A23. If the switch is "on", the corresponding address bit is compared with 0. If the switch is "off", it is compared with 1. If the address is the same as the switch setting (taking address modifiers into account), a "select" signal for the board is generated. In the short address range, the switches corresponding to A16 to A23 are ignored.

The selection between short address range and standard address range is made by the SRT switch. If SRT is switched on, short accesses are possible; if SRT is switched off, standard accesses are allowed.

Note: Please note that on B202S the DIL switches are not accessible anymore once you have installed M-Module 0! On B201S the DIL switches remain accessible even with the M-Module installed. (C.f. Chapter 1.1 Map of the Board on page 9.)

***Figure 5.*** *Setting the Base Address on B201S - Default (A24)*

**Default Mode**
A24

**Default Base Address**
0xE00000

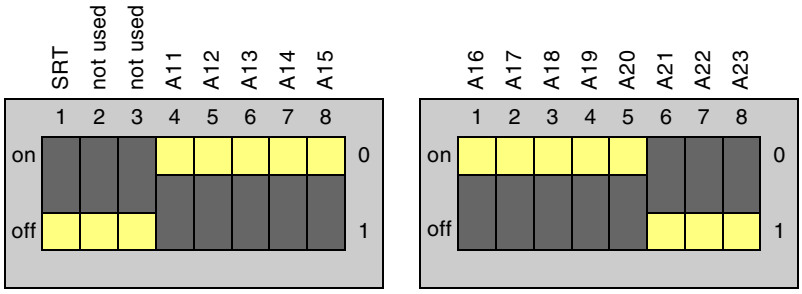



***Figure 6.*** *Setting the Base Address on B201S - Example (A16)*

**Example Address Mode**
A16

**Base Address**
0x4000

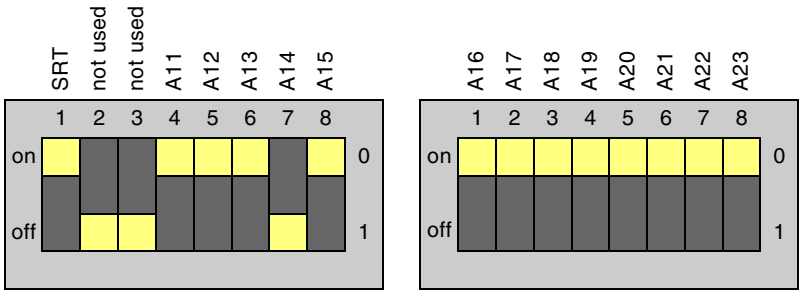



***Figure 7.*** *Setting the Base Address on B202S - Default (A24)*

**Default Mode**
A24

**Default Base Address**
0xE00000

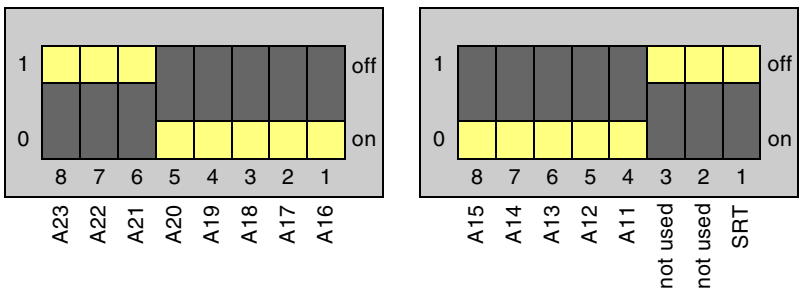
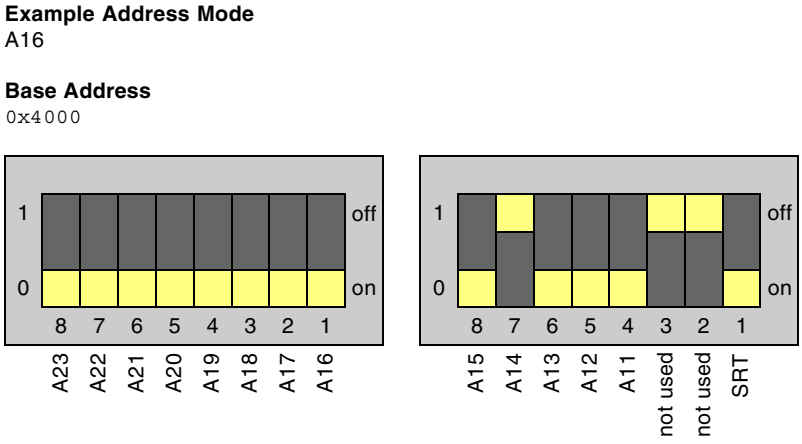


***Figure 8.*** *Setting the Base Address on B202S - Example (A16)*




### 3.2.1.2 Address Modifiers

The VMEbus has 6 "address modifier" lines. These lines allow the master to transfer additional binary information to the slave during a data transfer cycle. The lines are used to divide the address space of the VMEbus into several classes. The following codes are permitted for the A201S:

***Table 2.*** *Address Modifier Codes Permitted on A201S*

| HEX Code | AM 5 | AM 4 | AM 3 | AM 1 | AM 0 | Function | SRT |
|---|---|---|---|---|---|---|---|
| 3d, 39 | H | H | H | L | H | Standard supervisory and non-privileged data access | off |
| 2d, 29 | H | L | H | L | H | Short supervisory and non-privileged data access | on |

As mentioned above, SRT specifies standard or short access. The factory setting allows supervisor-mode and nonprivileged-mode access. Other address modes are possible in principle. They are specified in a programmable FLEX Logic component.

## 3.2.2 Interrupter

The interrupter has been implemented using a FLEX Logic IC. This chip permits interrupts to be issued at a programmable level. The B201S is a D08(O) interrupter. This means that the interrupter outputs status information on D0..D7 during an interrupt acknowledge cycle. Depending on which M-Module generates the interrupt it can be an RORA (= Release On Register Access) or an ROAK (= Release On Acknowledge) interrupt. This means that the interrupt request is reset either by the interrupt acknowledge cycle itself or by access to a specific register.

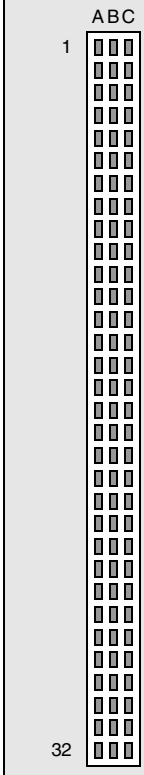
Since the interrupter is fully programmable, it is not necessary to set any jumpers or DIL switches.

### 3.2.3 VMEbus Connector P1

Connector types:

- 96-pin type-C plug connector according to DIN41612/MIL-C-55302/IEC603-2
- mating connector:
  type-C 96-pin receptacle according to DIN41612/MIL-C-55302/IEC603-2, available with solder/wire-wrap pins, for hand-soldering connection or for insulation piercing connection (IDC)

***Table 3.*** *Pin Assignment of the 96-Pin VMEbus P1 Connector*




| A | B | C |
|---|---|---|
| D0 | - | D8 |
| D1 | - | D9 |
| D2 | - | D10 |
| D3 | - | D11 |
| D4 | - | D12 |
| D5 | - | D13 |
| D6 | - | D14 |
| D7 | - | D15 |
| GND | - | GND |
| SYSCLK | - | - |
| GND | - | - |
| /DS1 | - | /SYSRST |
| /DS0 | - | /LWORD |
| /WRITE | - | AM5 |
| GND | - | A23 |
| /DTACK | AM0 | A22 |
| GND | AM1 | A21 |
| /AS | AM2 | A20 |
| GND | AM3 | A19 |
| /IACK | GND | A18 |
| /IACKIN | - | A17 |
| /IACKOUT | - | A16 |
| AM4 | GND | A15 |
| A7 | /IRQ7 | A14 |
| A6 | /IRQ6 | A13 |
| A5 | /IRQ5 | A12 |
| A4 | /IRQ4 | A11 |
| A3 | /IRQ3 | A10 |
| A2 | /IRQ2 | A9 |
| A1 | /IRQ1 | A8 |
| -12V | - | +12V |
| +5V | +5V | +5V |

## 3.3 M-Module Interfaces

One M-Module can be installed on the B201S, and two M-Modules on B202S. Peripheral equipment may be connected at the front using the front connector of the M-Module.

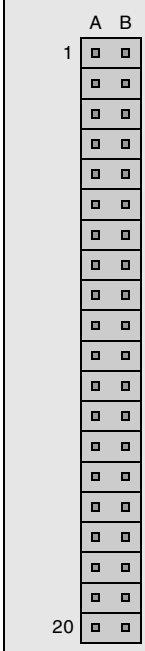
### 3.3.1 M-Module Connectors

The signals from the carrier board are fed to the M-Module via a 40-pin plug connector. This plug connector corresponds to a receptacle connector on the M-Module.

Connector types:

- two 20-pin plugs, 2.54mm pitch, square pins ∅ 0.635mm gold
- mating connector:
  two 20-pin receptacles, high-precision, 2.54mm pitch, for square pins ∅ 0.635mm gold, 6.9mm height

***Table 4.*** *Pin Assignment of the 40-Pin M-Module Plug Connector*




| | A | B |
|---|---|---|
| | /CS | GND |
| | A01 | +5V |
| | A02 | +12V |
| 1 | A03 | -12V |
| | A04 | GND |
| | A05 | - |
| | A06 | - |
| | A07 | GND12V |
| | D08 | D00 |
| | D09 | D01 |
| | D10 | D02 |
| | D11 | D03 |
| | D12 | D04 |
| | D13 | D05 |
| | D14 | D06 |
| | D15 | D07 |
| | DS1 | DS0 |
| 20 | /DTACK | /WRITE |
| | /IACK | /IRQ |
| | /RESET | SYSCLK |

## 3.4 Interrupt Controller

The FLEX Logic chip handles local interrupt sources with the VMEbus. It supports all signals used for the VMEbus interrupt protocol. Interrupt vectors from the local source of the interrupt can be passed on, and the chip also provides the capability of passing a pre-programmed vector. Eight internal registers (four status registers and four vector registers) are provided for general use.

### 3.4.1 Registers of the Controller

The interrupt controller contains eight programmable read-write registers. The four control registers control the activity of the chip, the other four are the vector registers, which contain the vector information for the IACK cycle. One pair of registers is allocated to the M-Module.

#### Control Registers (read/write)

| 7..6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|
| - | X/IN | IRE | IRAC | L | | |

*X/IN* external/internal
This bit governs behavior during an IACK cycle. If the X/IN bit is ’0’, the chip replies with the /DTACK signal and the vector stored in its vector register, i.e. it replies internally. If the X/IN bit is set, the M-Module has to generate the vector and the /DTACK signal.

*IRE* interrupt enable
This bit must be ’1’ to allow an interrupt to be generated at all. If this bit is ’0’, no interrupt is triggered on the VMEbus - even though an interrupt from the M-Module is pending.

*IRAC* interrupt auto clear
If this bit is set, the IRE bit is cleared during an IACK cycle (in response to this interrupt request) which disables the interrupt. In order to enable the interrupt again, the IRE bit must be set again by writing to the control register.

*L* interrupt level
These bits select the line on which the interrupt request is to be generated. ’111’ corresponds to IRQ7, ’110’ to IRQ6 etc. The code ’000’ disables interrupt generation.

#### Vector Registers (read/write)

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| V7 | V6 | V5 | V4 | V3 | V2 | V1 | V0 |

*V7..V0* interrupt vectors
If the X/IN bit is ’0’, this vector is generated at D0..D7 during the IACK cycle.

### 3.4.2 Power-Up/Reset Behavior

At power-up, the control registers are all loaded with `0x00`, the vector registers are set to the value `0x0F`. This value corresponds to the 68000 vector for an uninitialized interrupt.

After a reset only the interrupt level is set to zero.

# 4 Appendix

## 4.1 Literature and WWW Resources

- M-Module Standard:
  ANSI/VITA 12-1996, M-Module Specification;
  VMEbus International Trade Association
  7825 E. Gelding Dr., Ste. 104,
  Scottsdale, AZ 85260
  WWW: http://www.vita.com

## 4.2 Board Revisions

***Table 5.*** *Table of Hardware Revisions - B201S*

| Revision | Comment | Restrictions |
|---|---|---|
| 00.xx | first revision released | none known |
| 01.xx | second revision | none known |
| 02.xx | third revision | none known |

***Table 6.*** *Table of Hardware Revisions - B202S*

| Revision | Comment | Restrictions |
|---|---|---|
| 00.xx | first revision released | none known |

## 4.3 Component Plans

***Figure 9.*** *Component Plan of B201S Hardware Revision 02*

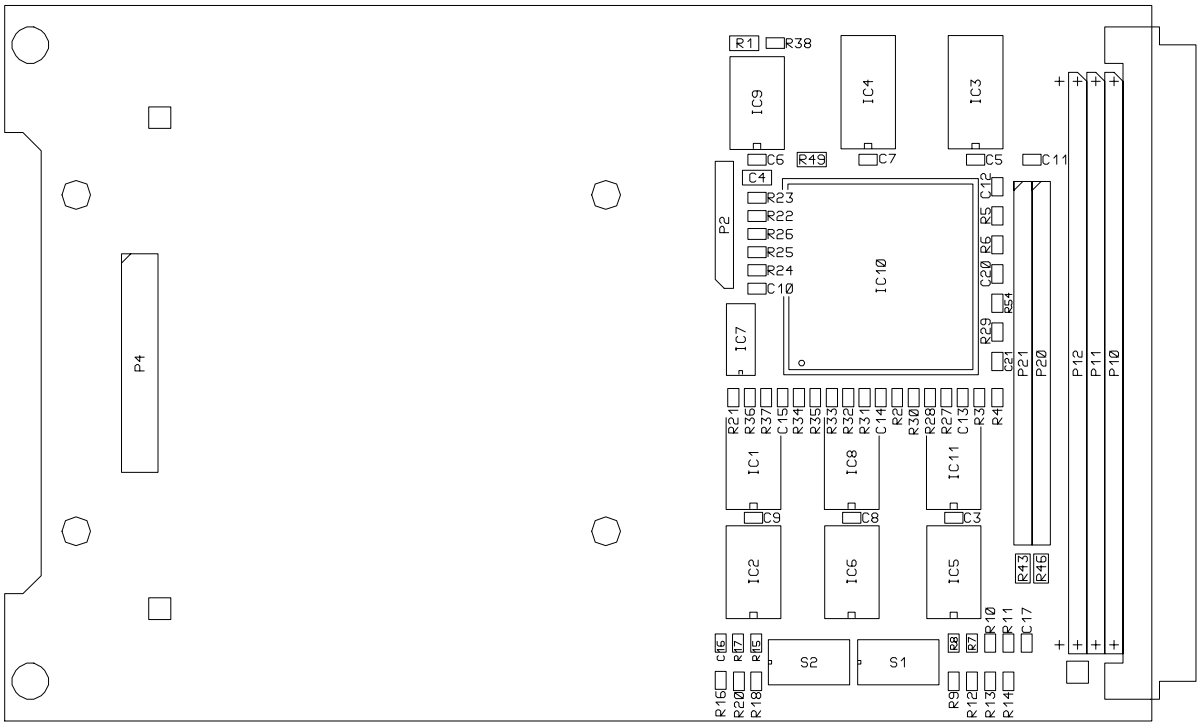
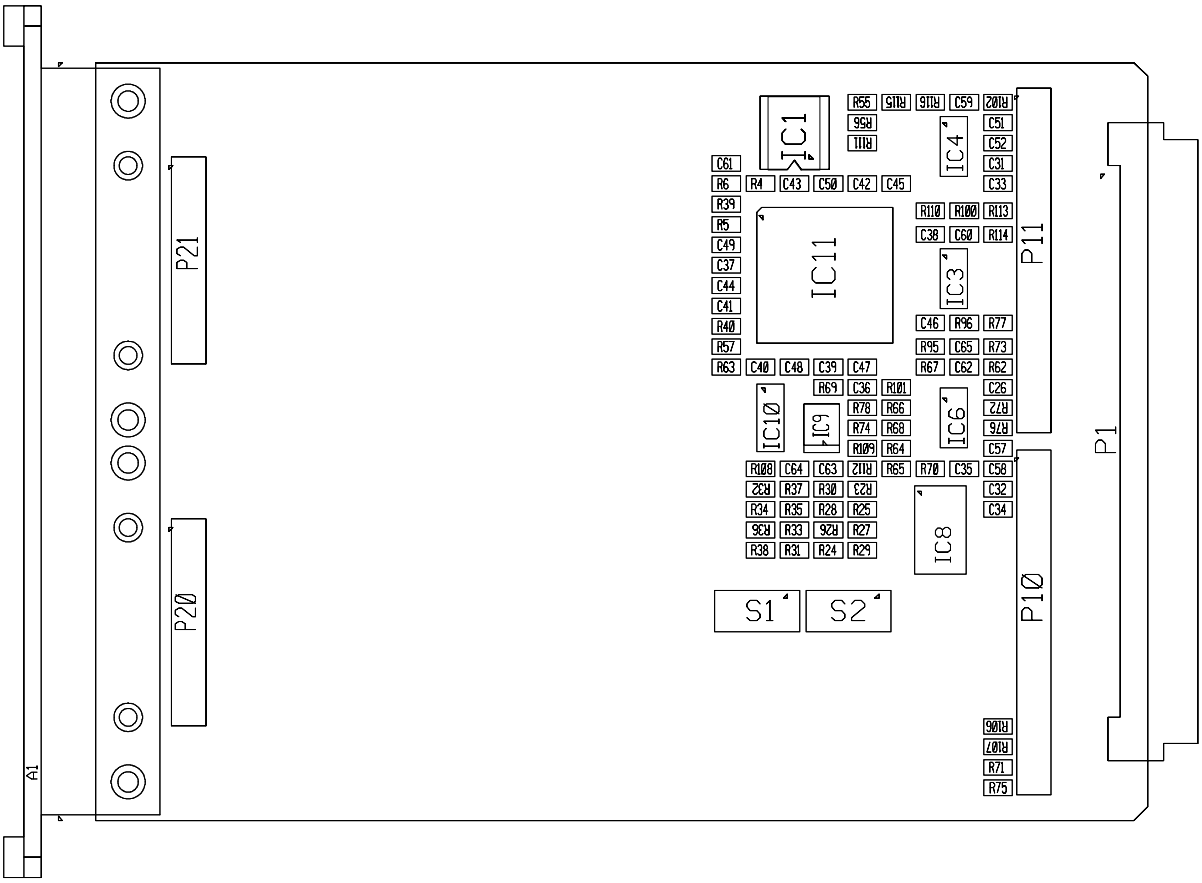


***Figure 10.*** *Component Plan of B202S Hardware Revision 00*



You can request the circuit diagrams for the current revision of the product described in this manual by completely filling out and signing the following non-disclosure agreement.

Please send the agreement to MEN by mail. We will send you the circuit diagrams along with a copy of the completely signed agreement by return mail.

MEN reserves the right to refuse sending of confidential information for any reason that MEN may consider substantial.

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**for Circuit Diagrams provided by MEN Mikro Elektronik GmbH**

**between**

MEN Mikro Elektronik GmbH
Neuwieder Straße 7
D-90411 Nürnberg

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**and**

_____
_____
_____
_____

("**Recipient**")

**We confirm the following Agreement:**

| **MEN** | | **Recipient** | |
|---|---|---|---|
| Date: | _____ | Date: | _____ |
| Name: | _____ | Name: | _____ |
| Function: | _____ | Function: | _____ |

Signature: Signature:

_____ _____

**The following Agreement is valid as of the date of MEN's signature.**

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gmbh · nürnberg

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Fax +49-911-99 33 5-99
E-Mail info@men.de
WWW www.men.de

ISO 9001 certified

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# Fax Reply

## Who you are...

**Name** _____ **Phone No.** _____

**Company** _____ **Fax No.** _____

**Department** _____ **E-mail** _____

## What we can do for you...

### Product Support

Product Article No. _____

Revision __ __ . __ __ . __ __

**If the product is a mezzanine module:**

Carrier Article No. _____

Revision __ __ . __ __ . __ __

**Operating system**

- ❍ OS-9
- ❍ VxWorks
- ❍ WindowsNT
- ❍ other:

_____

### Manual Feedback

Manual Article No. _____

Edition E ___

**Useful or awful?**

very useful ❍ ❍ ❍ ❍ ❍ totally awful

**Usage**

- ❑ I read the manual and decided to buy the related product.
- ❑ I read the manual when I got the product.
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